

C. Small Business Innovation Research (SBIR)



The purpose of DoD's SBIR program is to harness the innovative talents of our nation's small technology companies for U.S. military and economic strength. DoD's SBIR program funds early-stage R&D projects at small technology companies -- projects which serve a DoD need and have the potential for commercialization in private sector and/or military markets. The program, funded at over \$500 million in FY 2001, is part of a larger (\$1.2 billion) federal SBIR program administered by ten federal agencies.

As part of its SBIR program, the DoD issues an SBIR solicitation twice a year, describing its R&D needs and inviting R&D proposals from small companies -- firms organized for profit with 500 or fewer employees, including all affiliated firms. Companies apply first for a six-month phase I award of \$100,000 to test the scientific, technical, and commercial merit and feasibility of a particular concept. If phase I proves successful, the company may be invited to apply for a two-year phase II award of \$750,000 to further develop the concept, usually to the prototype stage. Proposals are judged competitively on the basis of scientific, technical, and commercial merit. Following completion of phase II, small companies are expected to obtain funding from the private sector and/or non-SBIR government sources (in "phase III") to develop the concept into a product for sale in private sector and/or military markets.

The Deputy Under Secretary of Defense (Science & Technology) SBIR Program is sponsoring two technology area initiatives this year, Cognitive Readiness Technology and Conditioned Based Maintenance Technology. We are also co-sponsoring two additional technology areas, biomedical technology and information technology for military health systems, with Defense Health Affairs.

All three Military Services are participating in the Office of the Secretary of Defense (OSD) program this year. The Service laboratories act as our OSD Agent in the management and execution of the contracts with small businesses. The Army, Navy, and Air Force laboratories, often referred to as a DoD Component acting on behalf of the OSD, invite small business firms to submit proposals under this SBIR program solicitation.

Objectives of the DoD SBIR Program include stimulating technological innovation, strengthening the role of small business in meeting DoD research and development needs, fostering and encouraging participation by minority and disadvantaged persons in technological innovation, and increasing the commercial application of DoD-supported research and development results.

The Cognitive Readiness focus area provides a cross-component, multidisciplinary S&T framework to focus on the human dimension of joint warfighting capabilities. In addition, Cognitive Readiness serves to highlight a useful criterion for

warfighting capability - fully prepared joint-warfighters, fighting and winning in an information rich, distributed firepower battlespace using human-centered hardware and systems.

The Cognitive Readiness focus area is intended to be highly responsive to achieving Joint Vision capabilities. *Joint Vision 2010* identifies readiness in terms of people, training, leader development, and first-rate equipment, as the foundation for enabling joint operational capabilities. *Joint Vision 2020* reinforces and extends this philosophy by emphasizing and encouraging human innovation as the key force multiplier of the future. Hence, the goal of the Cognitive Readiness focus area is to enable a high degree of Warfighter readiness and mission performance with affordable systems and a smaller force deployed across the globe under diverse conditions. For the full range of weapon systems and Joint Operational Capabilities, Cognitive Readiness technologies are integral to major gains in operability, effectiveness, and affordability.

The optimization and enhancement of human performance is challenged by many different factors, such as general health issues, mental and physical stress, cultural and societal influences, environmental stressors (e.g., heat, cold, altitude, information overload), adequate education and training. Currently, there are two "core" DoD program areas organized to address Cognitive Readiness issues, the Biomedical and Human Systems programs, with subcomponents dealing in health, psychology, sociology, personnel and training, and human factors engineering issues.

The Cognitive Readiness topics selected for this solicitation are listed below:

OSD01-CR01	Cognitive Fightability Index for Warrior Systems by the Army Research Laboratory
OSD01-CR02	Field-Practical Automated Battery for Assessing and Monitoring Cognitive Readiness by the Army Research Laboratory
OSD01-CR03	Screening Test for Detection of Major Psychiatric Disorders in Young Adults by the Army Medical Research Acquisition Activity
OSD01-CR04	3D Components for Virtual Environments By the Army Simulation and Training Command (STRICOM)
OSD01-CR05	Real Time Collective Performance Feedback For Combat by the Army Research Institute
OSD01-CR06	Scenario Based Decision Skills Training for Geographically Distributed Teams by Air Force Research Lab Human Effectiveness Directorate, Williams AFB
OSD01-CR07	Professional Leadership Development Skills Training for the 21 st Century by Air Force Research Lab Human Effectiveness Directorate, Brooks AFB
OSD01-CR08	Tactics, Training, and Procedures for the Warfighter Reacting to Crowd Dynamics by Air Force Research Lab Human Effectiveness Directorate, Brooks AFB

OSD01-CR09	Cognitive Demands of Warfighter Readiness by Air Force Research Lab Human Effectiveness Directorate, Williams AFB
OSD01-CR10	Assessment Methods for Tactical Knowledge and Cognitive Readiness of Intelligence Tasking, Processing, Exploitation and Dissemination (TPED) Teams by Williams AFB
OSD01-CR11	Authoring Shell for Case-Based Instruction by the Office of Naval Research
OSD01-CR12	The Grain Size Of Student Models As Factor In ICAI Effectiveness by the Office of Naval Research
OSD01-CR13	Toolbox/Intelligent Advisor for Creating Pedagogically Correct, Interesting and Motivating Instructional Content by the Naval Air Warfare Center
OSD01-CR14	Intelligent Assistant for Web-based Training Vignette Design by the Naval Air Warfare Center
OSD01-CR15	Instructional System for Enhancing Seakeeping Cognitive Readiness and Decision-Making Skills by the Special Operations Command

Maintenance comprises a major portion of the total operational cost for DoD weapons systems. Unnecessary or inappropriate maintenance contributes to inflated ownership costs and generally reduced readiness for deployable assets, while unscheduled maintenance requirements can be very costly and disruptive. Proper application of Condition-Based Maintenance (CBM) practices, which apply a methodology for the performance of maintenance only where there is objective evidence of need, as part of an overall maintenance effort can reduce operating and support (O&S) costs and work-hour requirements. Furthermore, maintenance decisions can be focused on those maintenance actions most needed to ensure safety and mission readiness. In doing so, CBM provides a means to manage the risk of mission-degrading failures.

Condition-Based Maintenance and Predictive Diagnostics are logical and appropriate successors to the very successful Reliability Centered Maintenance approach to equipment reliability and affordable operation. Ideally in condition-based maintenance, the operational health of specific components or a complex system is determined through sensors or a sensing system. This information then is used to make maintenance or operational usage decisions. Accurate and reliable predictors of current equipment health and the remaining useful life of equipment in service may be used to determine operating risk for the next operations or maintenance cycle, the most efficient scheduling of maintenance actions or inspections, or usage modifications to delay failure or repair. Prudent application of CBM has the potential to reduce operations and maintenance costs while stabilizing or increasing materiel readiness.

Advances in miniature sensors, life-prediction methodologies and real-time computation, signal processing and multi-sensor data fusion, and intelligent reasoning and control are providing a technological foundation for condition-based maintenance. Significant progress has been made in the rapid assessment of machinery condition

through monitoring debris in lubricating oils and the condition of oils themselves, severity of hidden corrosion and general corrosiveness of environments, and acoustic and vibrational measures. Nevertheless, major challenges face the practical implementation of CBM technologies and operational practicality. Among these are the development and integration of self-powered or power-harvesting wireless micro-sensors capable of operating in high thermal or high mechanical load environments; models and methodologies that can predict health and expected life based on physical, mechanical, or other measurements; reliable methods to measure and predict corrosion degradation in unstable environments; predictive tools for advanced materials, materials systems, and structures and design concepts for in-service monitoring; and design tools to assist in selecting the most appropriate monitoring approach for a specific mechanical or electrical system.

The Condition-Based Maintenance Topics are:

- OSD01-CBM01 Airframe Health Monitoring using Acoustic Emission Crack Detection with Bragg Grating by Naval Air Systems Command
- OSD01-CBM02 "Smart" Machinery Spaces by Naval Sea Systems Command
- OSD01-CBM03 Fully Automated Bearing Residual Life Prognosis Wireless Sensor by Naval Sea Systems Command
- OSD01-CBM04 Fiber Optic Strain Field Measurement for Aging Aircraft by the Air Force Research Laboratory, WPAFB
- OSD01-CBM05 Development of An Evanescent Microwave Probe Scanner for Detecting and Assessing Corrosion Beneath Painted and/or Sealed Surfaces by the Air Force Research Laboratory, WPAFB
- OSD01-CBM06 In-Line Health Monitoring System for Aircraft Hydraulic Pumps & Motors by the Air Force Research Laboratory, WPAFB
- OSD01-CBM07 In-Line Hydraulic Fluid Contamination Multi-Sensor by the Air Force Research Laboratory, WPAFB
- OSD01-CBM08 Fretting Fatigue Model by the Air Force Research Laboratory, WPAFB
- OSD01-CBM09 Reliability Algorithms for Corrosion Fatigue Assessments by the Air Force Research Laboratory, WPAFB
- OSD01-CBM10 Structural Component Substantiation Methodology by the Army Aviation and Missile Command
- OSD01-CBM11 Power Scavenging in a Cold, Dark Storage Environment by the Army Aviation and Missile Command
- OSD01-CBM12 Battery Optimized for Long Term Storage and Intermittent Use by the Army Aviation and Missile Command
- OSD01-CBM13 Non-Destructive Life Prediction and Component Interaction

- Fault Tree for Energy Related Systems by the Engineering Research and Development Center, Construction Engineering Research Laboratory
 • OSD01-CBM14 Smart Coating/Sensor Blankets for Health Monitoring by the Engineering Research and Development Center, Construction Engineering Research Laboratory

The Deputy Under Secretary of Defense (S&T) and Defense Health Program Office are jointly sponsoring this focus area to explore biomedical technology research issues. The biomedical technology area is focused to yield essential technology in support of the DoD mission to provide health support and services to U.S. Armed Forces. Most national and international medical S&T investment is focused on public health problems of the general population. Military medical S&T is concerned with developing technologies in order to preserve combatants' health and optimal mission capabilities despite extraordinary battle and non-battle threats to their well being. Preservation of individual health and well being sustains warfighting capabilities. The Biomedical Reliance Panel is included within the overarching structure of the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee, which provides joint coordination and cooperation to ensure synergy across all biomedical programs.

The biomedical technology topics are:

- OSD01-DHP01 Development of a Vaccine for the Treatment and/or Prevention of Cancer by US Army Medical Research Acquisition Activity
- OSD01-DHP02 Development of a Serum Based Biomarker for the Detection of Cancer by US Army Medical Research Acquisition Activity
- OSD01-DHP03 Lightweight Trauma Module by US Army Medical Research Acquisition Activity
- OSD01-DHP04 Photoactivated Chemical for Tissue Bonding by US Army Medical Research Acquisition Activity
- OSD01-DHP05 New Biosensors for Real-Time Terrestrial Toxicity Monitoring by US Army Medical Research Acquisition Activity
- OSD01-DHP06 Rapid Diagnostics for Detection of Respiratory Pathogens by the Naval Health Research Center
- OSD01-DHP07 Biomarkers of Musculoskeletal Soft-Tissue Injury by the Naval Health Research Center
- OSD01-DHP08 Production of Purified Recombinant Proteins for Development of Vaccines of Military Importance by the Naval Medical Research Center
- OSD01-DHP09 Reduction of Motion Side Effects and After Effects by the Special Operations Command

The Deputy Under Secretary of Defense (S&T) and Defense Health Program Office are jointly sponsoring this SBIR program focus area to do applied research on Information Technology (IT) issues directly supporting the Military Health System

(MHS). The MHS has approximately 80 major Military Treatment Facilities, 500 clinics, 160,000 healthcare personnel, and 8.3 million eligible beneficiaries. This health system results in approximately 900,000 outpatient visits and 10,000 hospital admissions per week.

The objective of these topics is to support the MHS optimization plan that includes the areas of: 1) Access to care, 2) Provision of care, 3) Manage the business and 4) Population health management.

The SBIR topics in this technology area, managed by Telemedicine and Advanced Technology Research Center, a part of Army Medical Research and Material Command at Ft. Detrick, Maryland are:

- OSD01-DHP10 Technology Enhanced Human Interface to the Computerized Patient Record
- OSD01-DHP11 Cognitive Patient-Clinician Encounter Model
- OSD01-DHP12 Health Information Data Mining